Technical Review

Hitachi Unified Compute Platform: Hyperconverged and Rack-scale Solutions for Hybrid and Multi-cloud Deployments

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Abstract

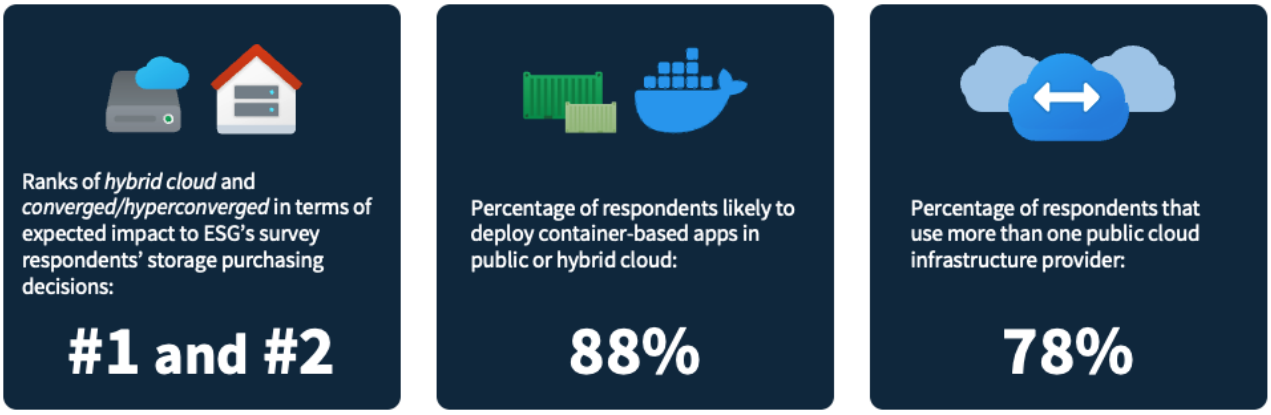
This ESG Technical Review documents our evaluation of Hitachi's hyperconverged Unified Compute Platform HC (UCP HC) and rack-scale Unified Compute Platform RS (UCP RS) (Cloud Foundation) solutions, with a focus on performance improvements delivered with the 2nd generation that includes a PCIe Gen 4-enabled chassis, 3rd generation Intel Ice Lake CPUs, and the latest Intel Optane NVMe drives.

The Challenges

According to ESG research, the most common objectives for digital transformation initiatives are to become more operationally efficient, to adopt digital tools and processes that allow users to interact and collaborate in new ways, and to provide better and more differentiated customer experiences.[1] To achieve these goals, many organizations are looking to hybrid and multi-cloud deployments. The operational expense model of these hybrid and multi-cloud deployments enables organizations to make the best infrastructure choice for every application (on-premises, or in any cloud) to optimize performance, availability, and cost. In fact, ESG research respondents reported that 79% of their on-premises apps and workloads were potential candidates to move to the cloud over the next five years.[2]

It is no surprise, then, that the top two storage features most likely to impact purchase decisions are hybrid cloud and converged/hyperconverged (Figure 1).[3] The ability to leverage cloud infrastructure can speed application deployments and save money, while hyperconverged infrastructure (HCI) enables application consolidation for both savings and simpler management. It is also worth noting that 88% of ESG respondents reported that they were likely to deploy containers in public or hybrid clouds.[4] Additionally, 78% of respondents in a separate survey reported using multi-cloud infrastructure.[5] Organizations recognize the value that cloud solutions offer for traditional and containerized applications.

Figure 1. Popularity of Hybrid, Multi-cloud, and Hyperconverged Infrastructures



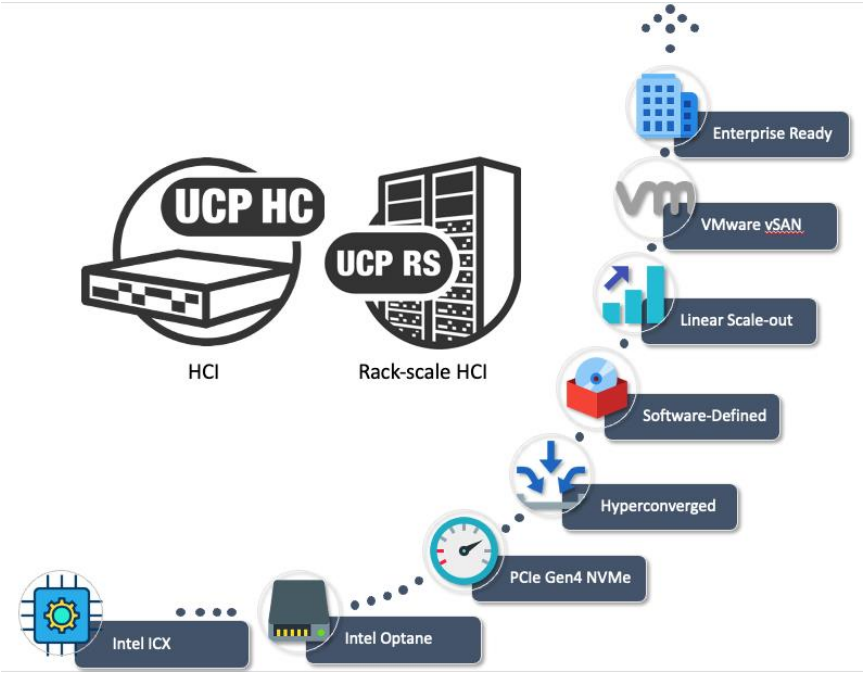
Source: Enterprise Strategy Group

[1] Source: ESG Research Report, *2021 Technology Spending Intentions Survey*, January 2021.
[2] Ibid.
[3] Source: ESG Research Report, *Data Storage Trends in an Increasingly Hybrid Cloud World*, March 2020.
[4] Ibid.
[5] Source: ESG Master Survey Results, *2021 Technology Spending Intentions Survey*, December 2020.

As organizations balance their use of on-premises and multi-cloud infrastructure, they need a strong foundation. Many choose hyperconverged infrastructure to focus on operational efficiency and ease of use, but they need a platform that delivers the high availability and performance that mission-critical applications demand.

The Solution: Hitachi UCP HC and RS

Hitachi Unified Compute Platform HC is Hitachi Vantara's purpose-built HCI solution incorporating VMware vSAN software-defined storage and Hitachi Unified Compute Platform servers. With easy scalability and seamless integration with the entire VMware stack, including VMware vSphere, vSAN provides flash-optimized, high-performance compute and storage, making it a simple storage platform for virtual machines and ideal for business-critical applications, virtual desktops, IT operations, or remote IT applications.



UCP also offers a turnkey, rack-scale version, UCP RS, powered by VMware Cloud Foundation for a fully software-defined data center (SDDC) cloud. UCP RS includes VMware NSX for network virtualization and secure micro-segmentation, and SDDC Manager for automated deployment and lifecycle management.

UCP HC scales from two to 64 nodes, and UCP RS scales up to 256 nodes in eight racks. Both solutions offer high-powered Intel Xeon Ice Lake processors, Intel Optane persistent memory, Intel Optane P5800X NVMe SSDs with PCIe 4.0, and 10/25 GbE PCIe 4.0 network interfaces, as well as native container orchestration with VMware Tanzu and VMware vVols storage virtualization with replication.

Both UPC HC and UCP RS aggregate locally attached storage into virtual datastores available to any VM in the hyperconverged cluster. The solutions include thin provisioning, compression, and deduplication, which significantly increase usable capacity with minimal performance impact to applications. Organizations deploying UCP HC and RS benefit from:

- **Maximum performance**—Delivered via an all-NVMe, PCIe 4.0 architecture, which also enables consistent low latency through flash-based caching and SSD data persistence.
- **Quality of service (QoS)**—Automatically controls and monitors IOPS consumption, eliminating noisy neighbor issues.
- **Self-tuning**—Automatically rebuilds and rebalances storage to align with QoS limits.
- **Capacity optimization**—Data reduction, deduplication, and compression improve storage capacity with as much as 10x data reduction while having minimal impact on server CPU and memory resources.
- **Data security**—Secures data with native FIPS 140-2 validated encryption.
- **Management simplicity**—The vSphere Web Client simplifies storage, compute, and networking management in a single, tightly integrated interface.
- **Maximum flexibility**—UCP HC nodes can be configured with 16-48 processor cores, 1-193TB useable capacity, NVMe or SATA SSDs, Intel Optane, AI GPUs, and 10Gbps and 25Gbps network to match nodes to workloads. UCP RS nodes can include all-flash or hybrid storage, GPU accelerators, and up to 323TB usable capacity.

- High availability—A policy-based framework enables IT to define VM and data availability with UCP HC/RS placing storage objects accordingly, providing programmable availability and fault tolerance, and minimizing data movement during distributed resource scheduling.
- Automated lifecycle management—Hitachi Unified Compute Platform Advisor provides complete lifecycle management for standalone and as-a service consumption, including day-0 provisioning and deployment, hardware and software inventory, remote monitoring for proactive troubleshooting, programmable management, programmable software and firmware lifecycle management and upgrades, and call-home support.

ESG Tested

ESG audited Hitachi Vantara performance testing that demonstrated increased performance with the UCP HC V124N G2 over the UCP HC V124N. We also reviewed results that demonstrated minimal performance impact when implementing Data-at-Rest-Encryption (DARE).

Performance Improvements with Hitachi Vantara DS G2 Servers in Hitachi UPC HC

First, ESG reviewed results of HCIBench testing that showed significant performance improvements with the second-generation Hitachi Vantara DS G2 nodes in UCP HC. The key technical advancements in the solution include:

- 3rd Generation Intel Xeon Ice Lake CPUs
- PCIe 4.0 chassis for increased bandwidth
- PCIe 4.0 Intel Optane P5800X SSDs
- 10/25 GbE PCIe 4.0 network interfaces

The test bed included first- and second-generation four-node vSAN clusters. Full configuration specs are listed in Table 1.

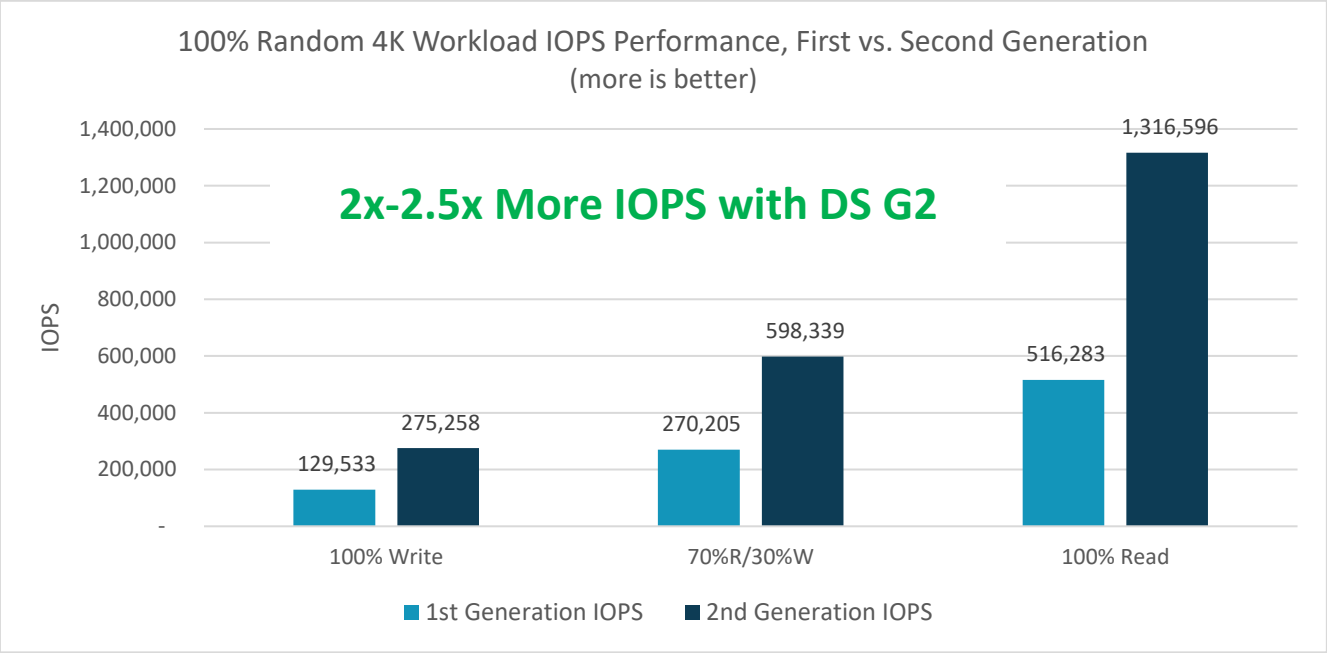
Table 1. UCP HCIBench Test Configuration

	UCP HC V124N All-NVMe G1 (Based on Intel Cascade Lake processors)	UCP HC V124N All-NVMe G2 All NVMe (Based on Intel Ice Lake processors)
Nodes	4-node vSAN cluster	4-node vSAN cluster
		vSAN over RDMA
Host Specs		
System	Hitachi Advanced Server DS120 (All NVMe)	Hitachi Advanced Server DS120 G2 (All NVMe)
Memory	384 GB RAM (12 x 32GB), DDR4 2666 MHz	512 GB RAM (16 x 32GB), DDR4 3200 MHz
CPU	2 x Intel Xeon Platinum 8276L (28 cores, 2.2GHz)	2 x Intel Xeon Gold 6338 (32 cores, 2.0GHz)
Cache	2 x Intel Optane P4800X 375GB	2 x Intel Optane P5800X 800GB
Capacity	6 x Intel DC P4510 4 TB	6 x Intel DC P4510 1 TB
Network	1 x Mellanox CX-4, dual-port	1 x Intel E810, dual-port
VMware	vCenter 6.7.0	vCenter 7.0U2b
	ESXi 6.7.0 EP5	ESXi 7.0 U2a
	vSAN 6.7	vSAN 7.0 U2
HCIBench	HCIBench_2.0/VDBench 5.04.06	HCIBench_2.5.3/VDBench 5.04.06
	Clear Read/Write Cache Before Each Testing	Clear Read/Write Cache Before Each Testing
vSAN/other	Disk groups: 2 x (1 + 3)	
	No dedupe/compression	
	vSAN storage policy: Default (RAID1)	

First, ESG reviewed the IOPS results of 100% random workloads. We reviewed 4KB to 256KB block sizes with 100% writes, 70% read/30% write, and 100% reads. For reference to typical enterprise workloads, 100% random write I/O and 100% random read I/O are typical of applications such as NoSQL databases, while 70%/30% read/write workloads are typical of

filesystems, SQL, and NoSQL. Figure 2 shows the IOPS results for 4KB block sizes, which demonstrate the highest performance. Note that for the 100% write and 70%/30% workloads, second generation IOPS performance was more than 2x first generation, and for 100% read, it was more than 2.5x, reaching more than 1.3 million IOPS.

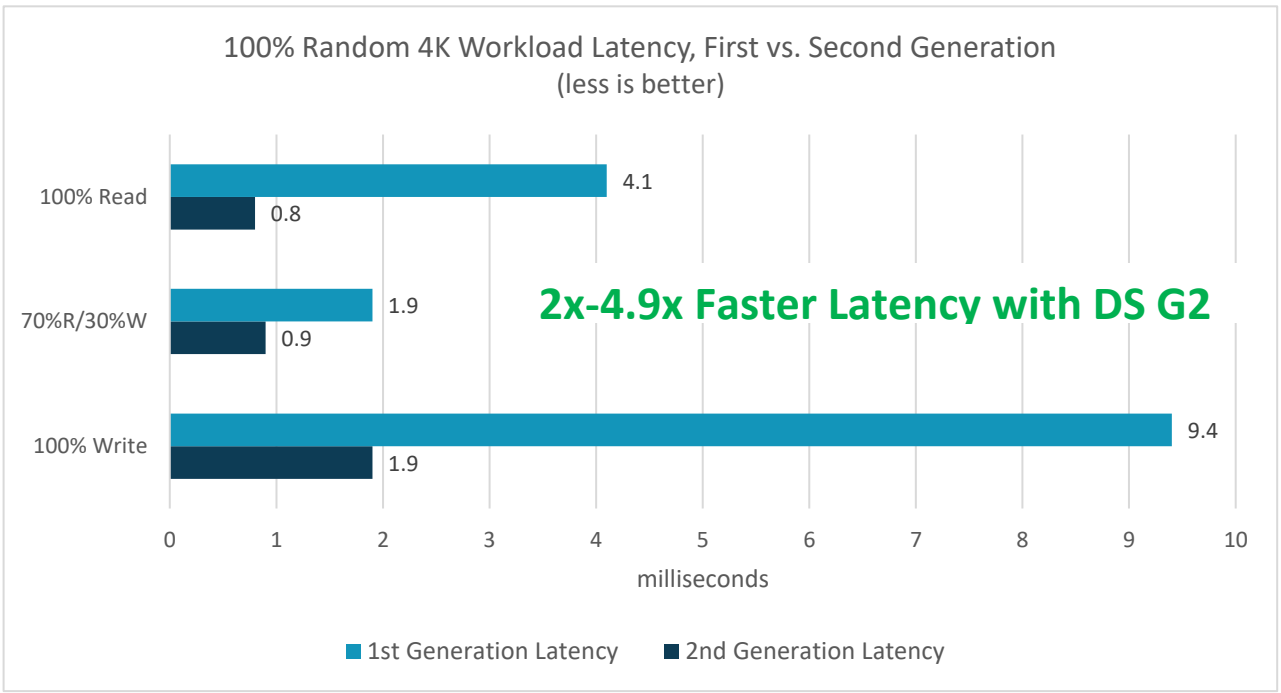
Figure 2. Random Workload IOPS



Source: Enterprise Strategy Group

Next, we looked at latency for the same 4KB workloads. In all cases, latency was reduced on the DS G2-based solution by at least 2x and up to 4.9x.

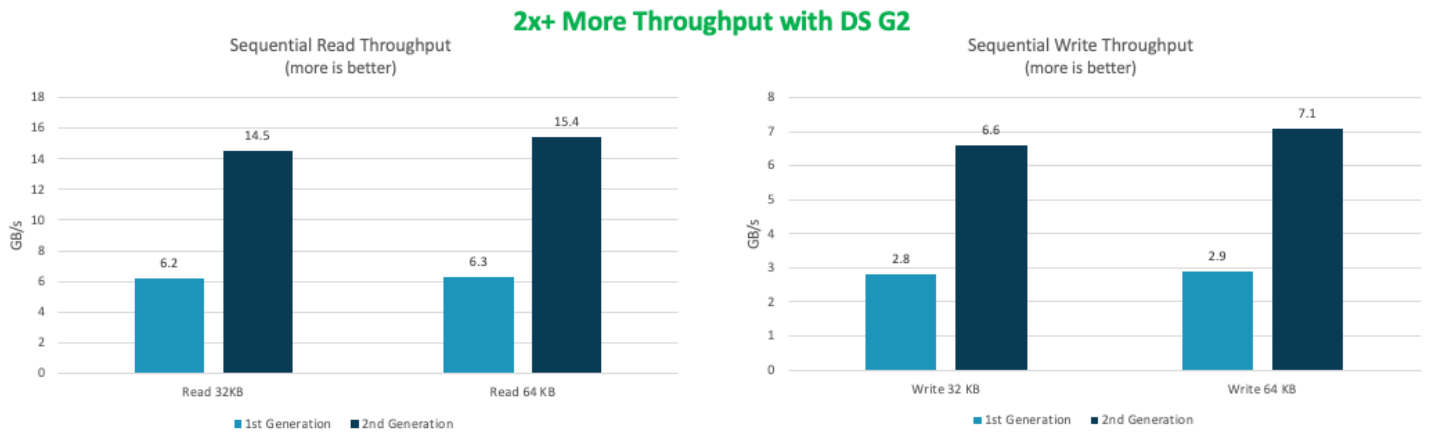
Figure 3. Random Workload Latency



Source: Enterprise Strategy Group

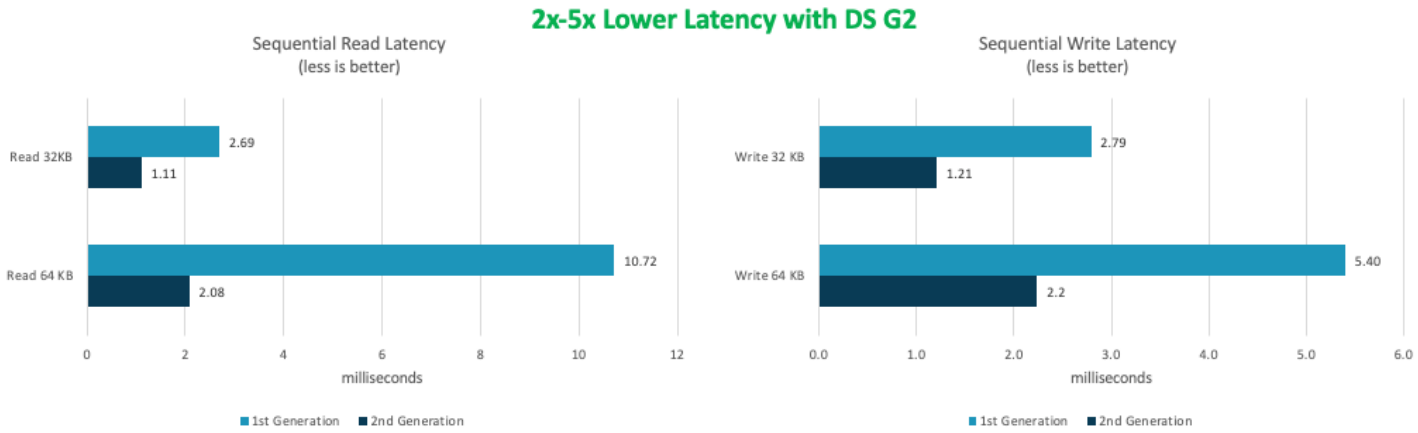
Next, ESG reviewed throughput results of sequential workloads, including 100% read (such as video streaming) and 100% write (such as backup and video surveillance). We noted similar results for block sizes of 32 KB up to 512 KB. Figure 4 demonstrates that the second generation delivered more than 2x throughput for both read and write workloads (32KB and 64KB), and Figure 5 shows that the second generation delivered 2x-5x lower latency for these workloads.

Figure 4. Sequential Workload Throughput



Source: Enterprise Strategy Group

Figure 5. Sequential Workload Latency



Source: Enterprise Strategy Group

Why This Matters

HCI can deliver greater efficiency, enabling organizations to consolidate multiple applications and save on infrastructure and management. But this is only a viable option if applications can maintain required performance levels.

Hitachi Vantara has improved its UCP HC offerings with advanced CPU, SSD, and PCIe technologies that deliver higher performance. Using a single, four-node UCP HC cluster, ESG validated more than 1.3 million IOPS with sub-millisecond latency, as well as at least 2x more IOPS and throughput and at least 2x faster latency for both random and sequential workloads.

Increased IOPS and throughput means organizations can run more VMs and applications, and reduced latency means better application performance and fewer timeouts, all on fewer nodes with less cost and maintenance.

Data-at-rest Encryption Performance

Data security is essential for all enterprises, and a vital method of protecting data is with encryption. Hitachi Vantara's DARE can protect UCP HC or RS data against storage-focused attacks, corruption, or theft. Using hardware-based AES encryption with 256-bit keys, DARE can protect every drive in your cluster with a unique encryption key, with minimal impacts to IOPS, latency, or CPU usage.

ESG audited Hitachi Vantara testing to evaluate the impact of DARE on UCP HC performance. Testing was conducted using both the standard encryption key provider HyTrust KeyControl and the vSphere native encryption key provider.

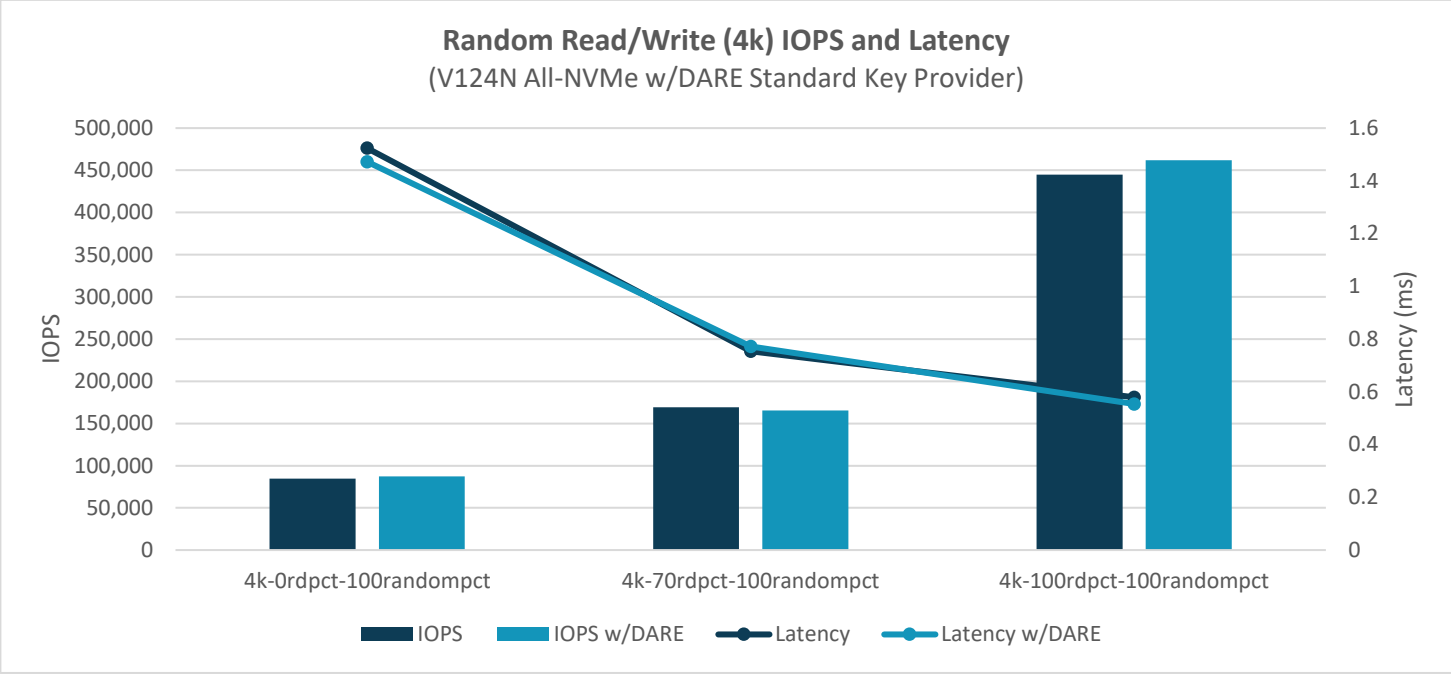
The test bed included a four-node UCP HC all-NVMe cluster with VMware vSphere and vSAN, plus a HyTrust KeyControl appliance in a separate cluster.

Table 2. Encryption Test Bed Configuration

	UCP HC V124N All-NVMe (Based on Intel Cascade Lake processors)
Node	4-node vSAN cluster
Host Specs	
System	Hitachi Advanced Server DS120 (All NVMe)
Memory	256 GB RAM (8 x 32GB)
CPU	2 x Intel Xeon Silver 4210 (10cores, 2.2GHz)
Cache	1 x 1.6TB Intel DC 4610
Capacity	3 x 1TB Intel DC P4510
Network	1 x Mellanox CX-4, dual-port
VMware	vCenter 7.0U2 RTM
	ESXi 7.0U2 RTM
	vSAN 7.0U26.7
HCIBench	HCIBench_2.5.3/VDBench 5.04.06
	Clear Read/Write Cache Before Each Testing
KMS	HyTrust KeyControl 5.3
Other	Single disk group (1+3), no dedupe/compression

The testing was conducted using HCIBench to demonstrate IOPS and latency on the cluster with and without DARE enabled. As Figure 6 shows, for 4KB random read and write workloads, the addition of DARE encryption using HyTrust KeyControl had very little impact on IOPS. Read, write, and mixed workloads demonstrated almost equal performance in IOPS and latency, with less than 5% variance. ESG validated very similar results for 8KB block size, and also when using the VMware native key provider. In addition, ESG validated that CPU usage for 4KB and 8KB random read, write, and mixed workloads increased by 5% or less with DARE enabled, with both key providers.

Figure 6. Minimal Impact of DARE UCP HC IOPS and Latency



Source: Enterprise Strategy Group

The Bigger Truth

As organizations strive to achieve their business objectives, they seek every advantage possible to become more operationally efficient. Technologies such as hyperconvergence have become extremely popular because HCI enables application consolidation that saves money on servers, storage, networking, power/cooling, and management. Similarly, more organizations are using cloud resources to augment on-premises infrastructure because they can get what they need much faster and with less infrastructure management, speed productivity, and pay only for what they use.

However, performance remains critical in HCI on-premises, hybrid, and multi-cloud deployments. Mission-critical applications like databases cannot suffer because of an infrastructure deployment decision. Faster performance means running more workloads, increasing productivity, and accelerating business outcomes.

With Hitachi Vantara's HCI and rack-scale solutions (UCP HC and UCP RS), organizations can count on a resilient, high-performance foundation that is flexible, secure, and simple to manage. Armed with the latest Intel CPUs, Optane SSDs, and PCIe 4.0, these HCI solutions are generating significant performance improvements. When comparing the first- and second -generation versions of UCP HC, ESG validated that the second generation delivers:

- 2x-2.5X more IOPS.
- 2x-4.9x faster latency.
- 2x+ more throughput.

In addition, ESG validated that performance was nearly identical with Hitachi Vantara's Data-at-Rest-Encryption (DARE) enabled, so organizations can be confident that adding this essential security features does not reduce performance.

Because every production data center is unique, it is important to plan and test in your own environment to validate the viability and efficacy of any solution. But if you are looking for a high performance, secure, resilient, easy-to-manage HCI solution—even at rack scale—ESG recommends taking a good look at Hitachi Vantara's UCP HC and UCP RS. Hitachi has upped its game with the latest performance-increasing technologies, giving customers the ability to run more workloads and increase efficiency, on-premises or in the cloud.